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REPRODUCTION AND NEST SITE SELECTION BY RED-WINGED BLACKBIRDS IN NORTH LOUISIANA

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The purposes of this study were to investigate reproductive variations and nest site selection of Red-winged Blackbirds (*Agelaius phoeniceus*) in primarily upland habitat in north Louisiana. This study provides further information on the nesting ecology of the Red-wing and research that is necessary in compiling an accurate picture of Red-wing population ecology throughout North America, as stressed by Gottschalk (1967). In addition, knowledge of local breeding populations is important, since most blackbird damage to rice is done by resident birds (Meanley 1971).

STUDY AREA AND METHODS

Most nests were found in Lincoln Parish, Louisiana, although significant numbers were found in other portions of north Louisiana within an area delimited by the borders of Texas and Arkansas, the Ouachita River, and the city of Alexandria. The study area, referred to as the Northwest Louisiana Uplands (St. Amant 1959), is generally hilly with elevations ranging from 15 to 161 m above sea level. A few rivers traverse the area, but most streams are small and slow-moving, subject to rapid rises and flooding. After reforestation, much of the area has developed a heavy second growth of native pines and hardwoods. The clearing of these forested areas along streams to provide pastures for cattle, man-made reservoirs, and small farm ponds has increased available Red-wing nesting habitats.

A total of 755 Louisiana Tech University museum record cards for active nests from 1963 to 1975 were available for analysis. Although some nests, represented by nest cards, were originally located by undergraduate ornithology students, all nests were checked (authenticated) one or more times by at least 1 of us or by ornithology graduate students who had previously conducted nest studies. In some instances observations denoted on the cards were incomplete. This is, in part, the reason for the variations in numerical totals for different categories of data.

During each of the annual nesting seasons a rather equal amount of time and effort was allotted to an overall search for nests, eggs, young, and related data. However, some types of data were collected only during 1975; these are so indicated when presented.

Various clues suggested the predators responsible for a nest loss. Eggshells present around the nest site indicated a mammalian predator. Loss of 1 or 2 eggs possibly indicated an avian predator, as did the presence of "peck holes." Snakes and mammals usually ate all eggs in a nest. Robertson (1972) stated that egg loss in nests not accompanied by significant nest damage was due to snakes or birds.

The season was divided into 2-week periods for the purpose of data analysis. Nests containing completed clutches that were discovered during the first 5 days of a 2-week period were considered to have been active during the immediately preceding period; as were nests with young. Those nests found that contained eggs during the first 5 days of a 2-week period were assumed to have been built in the preceding period; nests that contained young on the first 5 days of a period were assumed to have been built 2 periods

Table 1

Chronology of Nesting as Indicated by the Observed Number of Active Nests, Eggs, and Young Present in 2-week Periods, 1963 to 1975

	April		May		June		July		August
Category	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15
Number of active nests	2	102	535	243	102	58	23	6	2
Number of eggs	7	181	1405	522	181	148	40	14	5
Number of young		4	303	211	99	85	39	7	

previously. Nest building time was assumed to take 6 days (Bent 1958). Young per nest calculations are based on nests containing young, and not on total nests.

Only those eggs actually observed were included in the total number of eggs, including known unhatched eggs, but eggs as indicated by eggshells were not included. A complete clutch was one in which 2, 3, 4, or 5 eggs were successively counted during successive observations. Certain eggs were measured at random throughout the 1975 season with a Vernier beam caliper. If both eggs and young were present, the date the eggs were laid was calculated by adding the age of the young (Bent 1958, Holcomb and Tweist 1971) to the incubation period of 10 to 12 days (Allen 1914). The number of eggs and young present during 2-week periods was determined by tallying only the number of eggs of young observed during the period.

RESULTS AND DISCUSSION

Active nests with eggs were present from 7 April to 2 August (Table 1). Similarly, they occurred from 7 April to 23 August in Arkansas (Meanley 1971) and 30 April to 6 August in Ohio (Dolbeer 1976). The largest number of active nests occurred during the first half of May as were those recorded by Smith (1943) in Illinois. Elsewhere, the height of the nesting season occurred later: mid May in Ohio (Dolbeer 1976), late May in Connecticut (Robertson 1973) and New York (Allen 1914, Case and Hewitt 1963) among marsh nesters, but seems to occur in early June among upland nesters in New York.

Inactive nests were not tallied prior to 1975, but in 1975, 24 of 151 nests (16%) followed from the time nests were built were found in which no eggs or young were known to have been present; some of these may have been victims of snake predation. Bent (1958) and Goddard and Board (1967) found that many completed Red-wing nests were never used.

Of 2178 eggs recorded, 1461 made up 382 known completed clutches, for an average of 3.82 (range, 2–5) eggs per clutch. Two completed clutches had 2 eggs; 73, 3 eggs; 297, 4 eggs; and 10, 5 eggs. This was higher than

the average number of eggs reported by Robertson (1973) in Connecticut (3.37 to 3.50); by Dolbeer (1976) in Ohio (3.38); by Beer and Tibbitts (1950) in Wisconsin (3.7); by Orians (1961) in California (3.45 to 3.75); or by Meanley (1971) on the Arkansas Grand Prairie (3.2). Incubation usually begins after the third egg is laid (Bent 1958). But, in this study, many nests containing only 3 eggs were not included as completed clutches due to insufficient observations. If all clutches containing 3 or more eggs are included as completed clutches, then, average clutch size for this study is 3.66.

Bent (1958) reported that the range of eggs per completed clutch was 3 to 5. Goddard and Board (1967) in Oklahoma, and Case and Hewitt (1963) in New York found 1 to 5 eggs per clutch, while Orians (1961) in California found 1 to 6, and in this study, as well as Dolbeer's (1976), the range was 2 to 5. We found 2 nests in which there were 2 known eggs, laid, incubated, hatched and young successfully fledged. It is possible that some eggs were removed from these nests by predators or cowbirds or accidentally ejected. Since the active periods for these 2 nests were late June and early July it is also possible that these were second broods or renesting attempts. Double brooding (Meanley 1971), or renesting attempts is common (Smith 1943, Bent 1958, Goddard and Board 1967, Dolbeer 1976). Goddard and Board (1967) reported that clutch size does decrease later in the nesting season and Dolbeer (1976) found 2-egg clutches common late in the season in Ohio.

During the earliest and latest parts of the nesting season, clutches of 3 eggs were most common, whereas clutches of 4 eggs were most common during the peak of the nesting season (Table 2). Clutches containing 5 eggs were present only during the height of the nesting season.

The incubation period was 11 to 13 days. There were 36 known unhatched eggs among incubated clutches, 25 of which were recorded in 1975 when careful observations were made for this detail.

Average egg size of 303 eggs was 17.4×23.6 mm. Egg width ranged from 15.9 to 18.8 mm, whereas length ranged from 21.0 to 28.1 mm. Egg size was similar to the average of 17.5×24.8 mm for 380 eggs in the United States National Museum (Bent 1958). The lower range in both egg length and width is approximately the size of eggs laid by the Brown-headed Cowbird (this study and Bent 1958). There were no notable variations in egg size as the season progressed. Statistical analysis of average egg sizes seasonally showed no significant difference to exist (t-test, $P > .05$).

Nests were found in 30 species of plants, as compared to 30 in New York (Case and Hewitt 1963); 30 in Florida (Stowers et al. 1968); and 70 in Arkansas (Meanley 1971). Major Plant types used for nest support were buttonbush (*Cephalanthus occidentalis*), willow (*Salix* spp.), rush (*Juncus*

Table 2
Maximum Number of Eggs Known per Nest During 2-week Periods, 1963 to 1975

Number of eggs per nest	April		May		June		July		August
	a	b	a	b	a	b	a	b	a
1		8	39	24	14	11	1		
2		8	55	18	10	11	4	1	1
3	1	23	119	56	23	21	9	2	1
4	1	22	214	71	17	13	1	1	
5			7	2	2				
Average number of eggs per nest	3.5	3.0	3.2	3.1	2.8	2.6	2.7	3.0	2.5

spp.) bulrush (*Scirpus cyperinus*), cattail (*Typha* spp.), common alder (*Alnus serrulata*), sweetgum (*Liquidambar styraciflua*), dock (*Rumex* spp.) and grasses (*Graminae*) (Table 3). Plants of minor importance (used 1 to 9 times) were pine (*Pinus* spp.), cypress (*Taxodium* sp.), silverling (*Baccharis halimifolia*), vasey-grass (*Paspalum urvillei*), privet (*Ligustrum sinense*), wax-myrtle (*Myrica cerifera*), peach (*Prunus persica*), horse-chestnut (*Aesculus pavia*), oak (*Quercus* spp.), live-oak (*Quercus virginiana*), common elder (*Sambucus canadensis*), ironweed (*Vernonia* sp.), hawthorn (*Crataegus* spp.), redbud (*Cercis canadensis*), rose (*Rosa* sp.), sassafras (*Sassafras albidum*), blackberry (*Rubus* sp.), sumac (*Rhus* sp.), thorough-

Table 3
Season Use of Plant Species for Nest Support by Red-winged Blackbirds*

Supportive plant	April		May		June		July	
	a	b	a	b	a	b	a	b
Buttonbush	**	75	104	28	13	6	5	**
Willow	1	20	46	3	3	3		
Rush	**	16	23	2	1			
Bulrush		1	7	3	11	3	**	2
Cattail	1	9	10	1				
Common Alder		1	9	4	3	1		
Sweetgum		3	8	1	4	2	1	
Dock		5	9	5				
Grasses	1	10	30	1	2	**	1	

* Includes 498 nests, 1964–1975.
** Nests not observed but probably did occur.

TABLE 4
HEIGHTS OF 393 RED-WINGED BLACKBIRD NESTS, LISTED BY HABITAT TYPE[1]

Habitat	No. of plant species used	No. of nests	Ave. height of nests in m (range)
FRESHWATER AREAS			
Seasonally flooded basins (ditches, etc.)	9	117	1.2 (0.3–3.1)
Open freshwater areas (edge)	15	173	1.0 (0.2–4.0)
UPLAND AREAS			
Pasture (edge)	15	78	1.4 (0.3–7.6)
Cultivated areas (orchards, arboretum, etc.)	8	25	1.1 (0.2–3.0)
TOTALS	29	393	1.1 (0.2–7.6)

[1] Habitat types from Shaw and Fredine (1956).

wort (*Eupatorium perfoliatum*), persimmon (*Diospyros virginiana*) and cornel (*Cornus foemina*).

Of 554 nest sites for which the plant species was known, 261 (47%) were in buttonbush, a common hydrophilic shrub of marshes, lakes, and low pastures throughout the Southeast. Stowers et al. (1968) found buttonbush to comprise 28% of the plants used for nesting by the Red-wing in Florida. Cattail (90%) and willow (4%) comprised the majority of supportive plants used in Oklahoma (Goddard and Board 1967), whereas Robertson (1972) found cattail and dock to be the most used plants in Connecticut.

Variation in the average height of Red-wing nests within different habitats is shown in Table 4. The ratios of plants used changed from one habitat to another, as did plant occurrence (Table 4). In addition, the height of nests occurring in single plant species may differ with a change in habitat. On upland sites, it appeared to Francis (1973) that nest site selection was independent of height above the ground, but was related to the distance below the top of the vegetative canopy. Heights may be associated with the changing growth form of plants dictated by different environmental conditions in each habitat. Most nests tended to be lower when over open water, and higher when over seasonally flooded basins or pastureland (Table 4), although this was not always true. The largest number of nests occurred in open freshwater areas; possibly indicating that open freshwater is the preferred habitat in north Louisiana. A pooled t-test analysis of nesting habitats and nest heights (Table 4) indicates that a very highly significant difference in nest height existed between the 2 freshwater areas ($P < .001$). In addition,

Table 5
Nest Height and Nesting Success for 126 Active Nests, 1975

Height (m)	Number of nests	Number successful	Percent successful
0.0–0.6	16	2	12.5
0.6–1.2	32	9	28.1
1.2–1.8	43	14	32.5
1.8–2.4	21	7	33.3
2.4–8.0	14	3	21.5
Totals	126	35	27.8

a significant difference ($P < .05$) existed between upland and freshwater areas. Lesser differences were noted between upland habitats ($P < 0.10$).

Nesting success was compared with nest height (Table 5), depth of water below the nest (Table 6), and among the 6 major supportive plant types (Table 7).

From 1963 to 1975, 65 known successful nests were recorded. A more valid comparison of successful nests is given by careful observations made during 1975: 35 known successful (23.1%) nests and 9 probably successful (5.9%) out of 151. However, if only active nests are compared, 44 of 127 (35%) were successful, compared with 43% reported by Bent (1958), 29% in Wisconsin (Young 1963), 32% in New York (Case and Hewitt

Table 6
Depth of Water Below Nests and Nesting Success

Depth of water under nest (cm)	Number of nests	Number successful	Percent successful
127 ACTIVE NESTS (1975)			
0	76	24	35.1
1–15	39	7	17.9
over 15	12	4	33.3
totals	127	35	27.6
ISOLATED BREEDING POPULATION (1975)			
0	25	11	44.0
1–15	9	3	33.0
over 15	8	4	50.0
totals	42	18	43.0

1963), 50% in Maryland (Frankhauser 1964), and 53% in Pennsylvania (Brenner 1966). Nesting success of this study may be small due to individual breeding populations covered in this analysis having been relatively small compared to larger breeding populations that are often reported in extensive marshes. In larger nesting colonies, predation pressure per individual nest is much lower than in small colonies (Darling 1938, Fautin 1941, Smith 1943, Robertson 1973). However, in this study, an upland breeding population of 42 nests had 43% success in 1975, a slightly higher success rate than all other nests combined for that year (Table 6).

We observed 685 young in 239 nests for the average of 2.87 (range, 1–5) young per nest. An average of 2.77 young per nest were fledged from the 65 successful nests, from 1963 to 1975. For the 1975 season alone, 2.97 young were known fledged per successful nest. The average number of young fledged per active nest ($N = 127$) in 1975 was 0.83. This compares to 0.6 in New York (Case and Hewitt 1963), and as high as 1.9 in Ohio (Francis 1975). Dolbeer (1976) reported the average number of young fledged annually per female as 1.3 in Ohio. In this study, young were present from 25 April to 23 July, with the largest number of young recorded in early May (Table 1).

Meanley (1971) reported that nesting success was higher in nests more than 0.6 m above the ground, while Goddard and Board (1967) noted that lower nests were more successful; however, the majority of those nests were over water in cattails. Data in Table 5 indicate that nests in the 1.2 to 1.8 m range and 1.8 to 2.4 m range were similarly successful (32.5% and 33.3%) and nests at 0.6 to 1.2 m were only slightly less successful (28.1%). Low success (12.5%) for nests 0 to 0.6 m high was due, largely, to predation. The highest nests (over 2.4 m) were not necessarily the most successful (21.5%). This may have been due to weather factors, e.g., those nests knocked down by wind and rain (Francis 1971). Goddard and Board (1967) and Robertson (1972) observed that nesting success was greater as the depth of the water below the nest increased. The smaller number of nests over deep water were as successful (33.3%) as all the combined nests over land (31.5%) (Table 6). The nests over shallow water (1 to 15 cm) had poor nesting success (17.9%). This may be due, in part, to the fact that nests over water tend to be lower (Table 4), whereas the shallow water would not afford the protection of nests over deeper water (Table 6).

Nesting success is also partially related to sturdier vegetation forms which adequately support nests through periods of severe weather (Francis 1971). Buttonbush and bulrush were the most commonly used supportive plants and nests placed in these plants also had relatively high success, 32% and 26%, respectively, of all successful nests (Table 7). The grouping of all other

Table 7
Supportive Plant Type and Nesting Success for 127 Active Nests in 1975

Supportive plant	Number of nests	Number known successful	Percent successful
Buttonbush	50	16	32
Willow	7	1	14
Rush	12	1	8
Bulrush	23	6	26
Cattail	5	0	0
Common Alder	13	3	23
Others	17	8	47
Totals	127	35	28

seldom-used plants had a rather high success (47.1%); the reason for which is not clearly understood. Robertson (1972) also observed a relatively high success in rarely-used upland woody vegetation. He suggested that these favorable nesting sites are not used more often because they are poorly suited for the grouped territorial nesting pattern to which Red-wings are adapted.

Only 174 (22%) known unsuccessful nests were recorded out of 755 active nests, from 1963 to 1975, compared to 82 (65%) unsuccessful nests recorded out of 126 carefully observed active nests in 1975. In 1975, 88 instances of predation occurred on the 82 nests. Nest losses not accompanied by significant nest damage, an indication of probable snake or bird predation, were most common (56 of 88 occurrences) throughout the nesting season. Mammalian predators played a lesser role (27); whereas weather (3) and mowing or grazing (2) were rather insignificant contributors to lack of nesting success.

Other losses can be attributed to the Brown-headed Cowbird (*Molothrus ater*). Smith (1943) found the incidence of parasitism by the Brown-headed Cowbird to be from 5% (1940) to 0.6% (1941) for the same location. We found 12 of 755 (1.6%) active nests were parasitized from 1963 to 1975. Sixteen cowbird eggs were laid, including 1 nest with 3 cowbird eggs, 2 nests with 2 eggs, and 9 nests with 1 egg. In the 12 parasitized nests, an average of 2.2 (range, 1–4) Red-wing and 1.3 cowbird eggs were present. Cowbird eggs were found in Red-wing nests from 30 April to 29 May at heights of 1 to 2.5 m in a wide range of supportive plants in all the major habitat types. The cowbird laying peak seemed to coincide with the peak laying period of the Red-wing (Goertz 1977). In 1975, 2 cowbird eggs were measured, being 15.8 × 20.8 mm and 16.4 × 19.8 mm, only slightly smaller than Red-wing eggs.

SUMMARY

Data were collected on 755 active nests of the Red-winged Blackbird (*Agelaius phoeniceus*) in a largely forested area of north Louisiana from 1963 to 1975. Nesting began in early April and continued until early August; the height of the nesting season was during May. Completed clutches contained an average of 3.82 eggs (range, 2 to 5); broods contained an average of 2.87 (range, 1 to 5) young. During 1975, 0.83 young fledged per nest for 127 active nests.

Thirty species of plants were used as nest sites, with the ratios of plants used being different in each of the 4 major habitats. Average nest height varied with the habitat in which the nest was located. Open freshwater areas were the most heavily used habitats. Nesting success was directly related to the height of the nest, depth of water below the nest, type of vegetation used for nest support, and nesting habitat. Predation was a major factor involved in nest loss.

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LITERATURE CITED

Allen, A. A. 1914. The Red-winged Blackbird: a study in the ecology of a cat-tail marsh. Proc. Linnaean Soc. New York 24–25:43–128.

Beer, J. R., and D. Tibbitts. 1950. Nesting behavior of the Red-winged Blackbird. Flicker 22:61–77.

Bent, A. C. 1958. Life histories of North American blackbirds, orioles, tanagers, and allies. U.S. Natl. Mus. Bull. 211.

Brenner, F. J. 1966. The influence of drought on reproduction in a breeding population of Red-winged Blackbirds. Am. Midl. Nat. 76:201–210.

Case, N. A., and O. H. Hewitt. 1963. Nesting and productivity of the Red-winged Blackbird in relation to habitat. Living Bird 2:7–20.

Darling, F. F. 1938. Bird flocks and the breeding cycle. Cambridge University Press, England.

Dolbeer, R. A. 1976. Reproductive rate and temporal spacing of nesting of Red-winged Blackbirds in upland habitat. Auk 93:343–355.

Fautin, R. W. 1941. Development of nestling Yellow-headed Blackbirds. Auk 58: 215–232.

Francis, W. J. 1971. An evaluation of reported reproductive success in Red-winged Blackbirds. Wilson Bull. 83:178–185.

———. 1973. Blackbird nest placement and nesting success. Wilson Bull. 85:86–87.

———. 1975. Clutch size and nesting success in Red-winged Blackbirds. Auk 92: 815–816.

Frankhauser, D. P. 1964. Renesting and second nesting of individually marked Red-winged Blackbirds. Bird-Banding 35:119–121.

Goddard, S. W., and V. V. Board. 1967. Reproductive success of Red-winged Blackbirds in north central Oklahoma. Wilson Bull. 79:283–289.

Goertz, J. W. 1977. Additional records of Brown-headed Cowbird nest parasitism in Louisiana. Auk 94:386–389.

Gottschalk, J. S. 1967. The federal role in dealing with the blackbird problem. Pp. 26–32 *in* Proceedings of the North American conference on blackbird depredation in agriculture (M. L. Giltz, Ed.). Neil House, Columbus, Ohio.

Holcomb, L. C., and G. Twiest. 1971. Growth and calculation of age for Red-winged Blackbird nestlings. Bird-Banding 42:1–17.

Meanley, B. 1971. Blackbirds and the southern rice crop. Bur. Sport Fish. Wildl. Resource Publ. 100.

Orians, G. H. 1961. The ecology of blackbird (*Agelaius*) social systems. Ecol. Monogr. 31:285–312.

Robertson, R. J. 1972. Optimal niche space of the Red-winged Blackbird (*Agelaius phoeniceus*). I. Nesting success in marsh and upland habitat. Can. J. Zool. 50: 247–263.

———. 1973. Optimal niche space of the Red-winged Blackbird: spatial and temporal patterns of nesting activity and success. Ecology 54:1085–1093.

Shaw, S. P., and C. G. Fredine. 1956. Wetlands of the United States. Fish and Wildl. Serv. Circ. 39.

Smith, H. M. 1943. Size of breeding populations in relation to egg-laying and reproductive success in the Eastern Red-winged Blackbird (*Agelaius phoeniceus*). Ecology 24:183–207.

St. Amant, L. S. 1959. Louisiana wildlife inventory and management plan. Louisiana Wildl. Fish. Comm., Baton Rouge.

Stowers, J. F., D. T. Harke, and A. R. Stickley. 1968. Vegetation used for nesting by the Red-winged Blackbird in Florida. Wilson Bull. 80:320–324.

Young, H. 1963. Age-specific mortality in the eggs and nestlings of blackbirds. Auk 80:145–155.

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